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TECHNOLOGY UTILIZATION

HAND AND POWER TOOLS

A COMPILATION



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Foreword

The National Aeronautics and Space Administration has established a Technology Utilization Program for the dissemination of information on technological developments which have potential utility outside the aerospace community. By encouraging multiple application of the results of its research and development, NASA earns for the public an increased return on the investment in aerospace research and development programs.

This document is one in a series intended to furnish such technological information. The Compilation is divided into three sections. Section One describes several tools and shop techniques that may be useful in the home or commercial shop. Section Two contains descriptions of tools that are particularly applicable to industrial work, and in Section Three a number of metal working tools are presented.

Additional technical information on the items in the Compilation can be requested by circling the appropriate number on the Reader Service Card included in this Compilation.

The latest patent information available at the final preparation of this Compilation is presented on the page following the last article in the text. For those innovations on which NASA has decided not to apply for a patent, a Patent Statement is not included. Potential users of items described herein should consult the cognizant organization for updated patent information at that time.

We appreciate comment by readers and welcome hearing about the relevance and utility of the information in this Compilation.

Jeffrey T. Hamilton, *Director*
Technology Utilization Office
National Aeronautics and Space Administration

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Section 1. Shop Tools and Techniques

REMOVAL OF RETAINING WASHERS OF THE WAFFLE-SPRING TYPE

Several makes of quick-locking fasteners incorporate retaining washers of the waffle-spring type; they are widely used in the aircraft and aerospace industries for such things as panels and covers that must be removable.

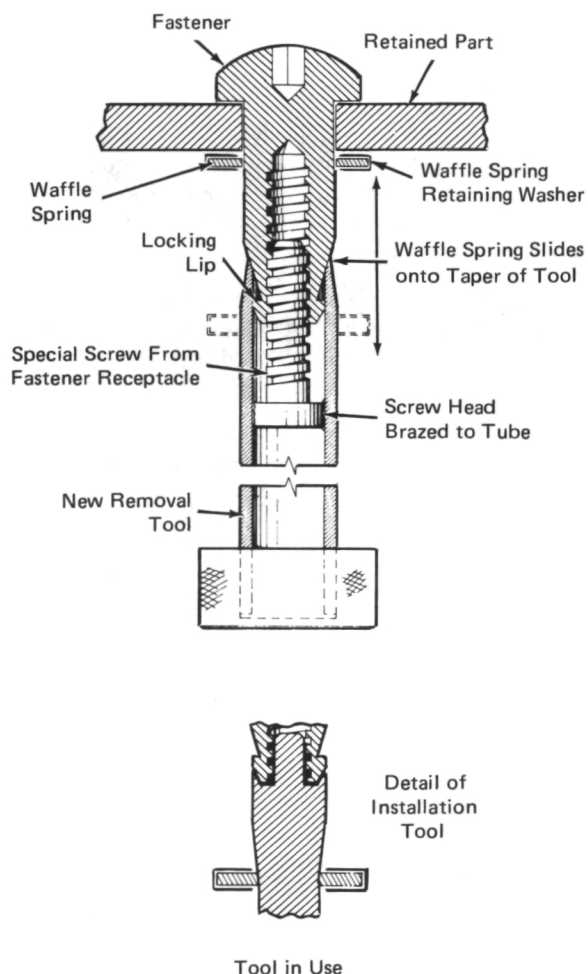
The retainers are locked to the fasteners by internally expanding waffle springs; their removal is prevented by locking lips at the ends of the fasteners, so that they must be cut (and destroyed) for removal.

Retainers can be removed easily with a special tool made quite similarly for various sizes and makes of fastener. Now to be described is the prototype of a tool for a 0.25-in. (0.635-cm) fastener.

One end of a 1.5-in. (3.8-cm) length of 0.25-in. (0.635-cm) (outer diameter) stainless-steel tubing is reamed to 15/64-in. (0.595-cm) to a depth of 15/32 in. (1.19 cm). The head of a screw from a nut plate is machined to a diameter of 0.233 in. (0.592 cm) before the screw is pressed head-first into the reamed end of the tubing and sweated in place, with the threaded end protruding at least 0.012 in. (0.030 cm). The outside of 0.25 in. (0.635 cm) of this end of the tube is tapered and polished. Over the other end of the tube is pressed and sweated a knurled head as a finger grip.

The first step in withdrawal of the retainer is removal of the nut-plate assembly. The screw end of the tool is then screwed finger-tight into the internal thread of the fastener, before the tool is pushed against the fastener until the retainer is forced over the taper. The tool is then withdrawn, carrying the retainer with it. The undamaged retainer is left on the tool until it is replaced.

Source: R. A. Marzullo of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-15531)



No further documentation is available.

A CONCEPT FOR UNIVERSAL PLIERS

Pliers are available in many sizes and shapes for a variety of uses. To own a complete set of pliers for a given occupation or hobby, the user faces an unnecessary expense of purchasing a number of such tools. By a modification in the existing design, pliers can be made to have one pair of handles that will accept a number of different jaws.

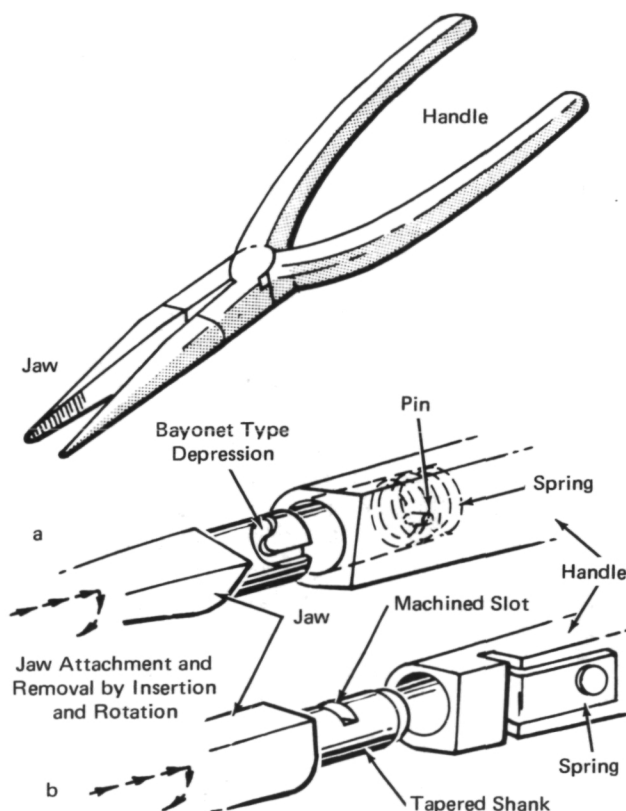


Figure 1. Universal Pliers

There are two possible designs for insertion and locking of plier jaws into the handle, as shown in Figures 1 (a) and (b). In both designs, the jaws are attached and removed by a push and twist method. The first design concept [Figure 1 (a)] is a spring-loaded bayonet mechanism. Each handle has a hole that is pinned at a point in its depth. Past the pin and held in the handle hole by the pin, is a spring. The cylindrical jaw shank fits into the handle hole. Machined into the shank is a recess of the shape shown. The jaw is

inserted into the handle, engaging the internally projecting pin. Further insertion will compress the spring, and the shank recess will guide the jaw so that it can be rotated into the locking position in the bayonet depression.

The other design concept [Figure 1 (b)] is similar in insertion and removal techniques, but it utilizes a spring to lock and hold the jaw. When the taper in the jaw shank is inserted into the hole in the handle, the spring is forced to flex and allow jaw insertion to the point of the machined slot in the shank. A rotation of the jaw will allow the spring to enter the slot, effectively locking the jaw to rotation and pull. Removal is made by rotation to either direction which will force the spring out of the slot to the point where a straight pull will allow the jaw to be removed.

Figure 2 (a) shows another useful modification. Included in one handle of the pliers is a threaded rod with a knurled head. The rod is stored in the handle, and retained by a few threads. The rod is used to provide positioning of the handles when it is placed through a hole in one handle and into a corresponding threaded hole in the other handle. With this feature, the pliers can be used to spread such things as snap rings or to clamp onto and hold articles so the hands can be left free.

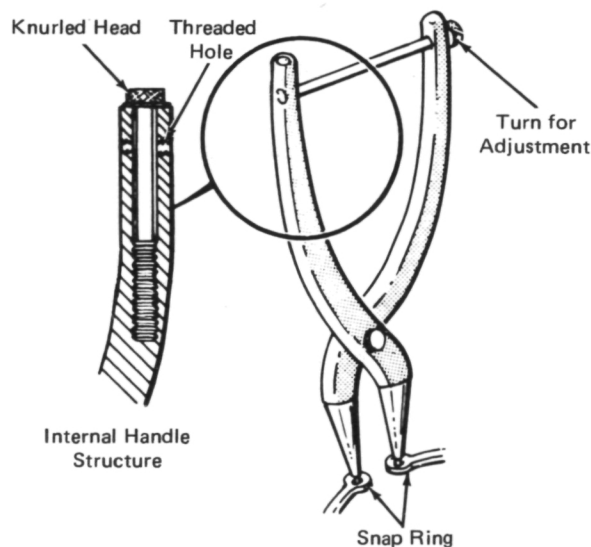


Figure 2 (a). Adjustment Feature

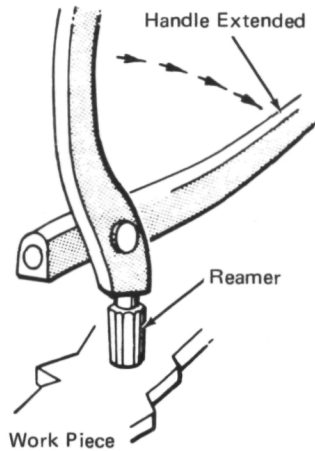


Figure 2 (b). Use of One Jaw For Rotary Work

Finally, Figure 2 (b) shows the pliers when one handle and jaw are used as a rotating tool. Rethreading tapped holes, light burring, and reaming are a few of the ways this feature may be used. The sketch in Figure 2 (b) shows a reaming operation. The unused handle is opened to its extreme position to provide additional rotating leverage.

These adaptations should be useful for light to medium duty service. A complete set of jaws may be made to suit specific hobbies or applications, i.e., electronics, watchmaking, automotive or electrical work.

Source: E. T. Neal of
The Boeing Company
under contract to
Kennedy Space Center
(KSC-10768)

No further documentation is available.

IMPROVED TECHNIQUES FOR CLEANING TOOLS

Hand tools that are cleaned in Freon to rid them of dirt, grease, and oil tend to corrode or rust, even if they may be corrosion resistant. This probably occurs because Freon contains a small amount of water, which collects on the tools after washing. To solve this problem, another step has been added in the cleaning procedure.

After washing in Freon, the tools are rinsed in pure methyl alcohol. The alcohol dilutes any water on the tools, and continued rinsing removes the water. After the tools have been rinsed thoroughly, they are dried in an air shower. Incorporating this step in the cleaning

process eliminates the rust problem. This improved procedure presently is being used to clean hand tools prior to use in a clean room.

Source: K. H. Kildow of
The Boeing Company
under contract to
Kennedy Space Center
(KSC-10024)

No further documentation is available.

SPECIAL TOOL FOR INSTALLING SQUEEZE RIVETS

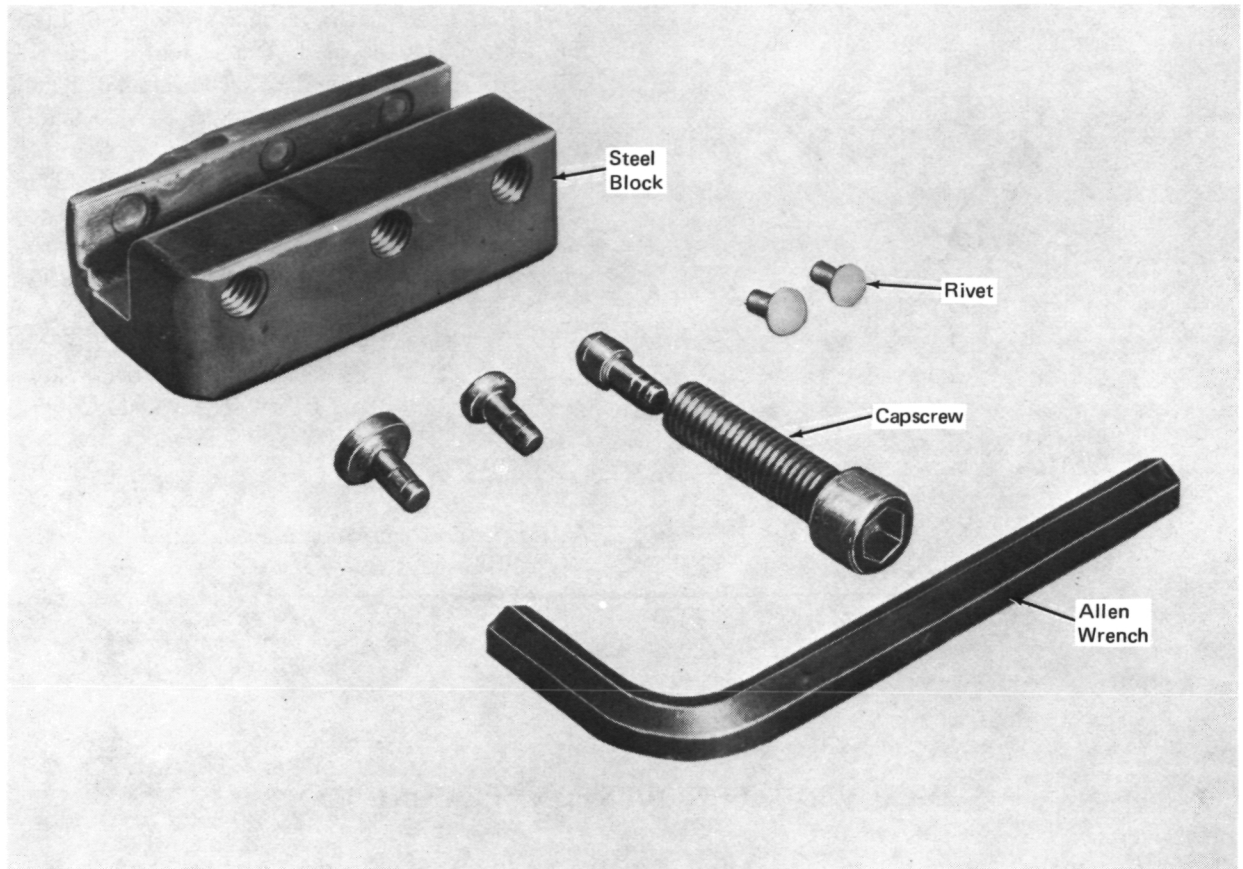


Figure 1. Squeeze Rivet Installation Tool

An inexpensive, easily fabricated, manually operated tool can be used to install squeeze rivets in highly inaccessible areas. It will accommodate either flathead or roundhead rivets up to #5 size. Blind rivets generally are not satisfactory as replacements for squeeze rivets where structural integrity is critical. Thus, when performing modifications, extensive additional disassembly is often required to permit positioning of the bulky tools used to install replacement rivets. Alternatively the rivet set may be hammered out, which usually results in an out-

of-tolerance rivet upset. The new tool supports rivet sets for various rivet head shapes and permits an accurate application of torque to upset the rivet against a block (Figure 1).

The tool incorporates an allen socket-head capscrew with the shank drilled out to allow insertion of rivet sets. The capscrew then is threaded into a steel block having a machined cutout, which straddles the area to be riveted and serves as a bucking bar to upset the

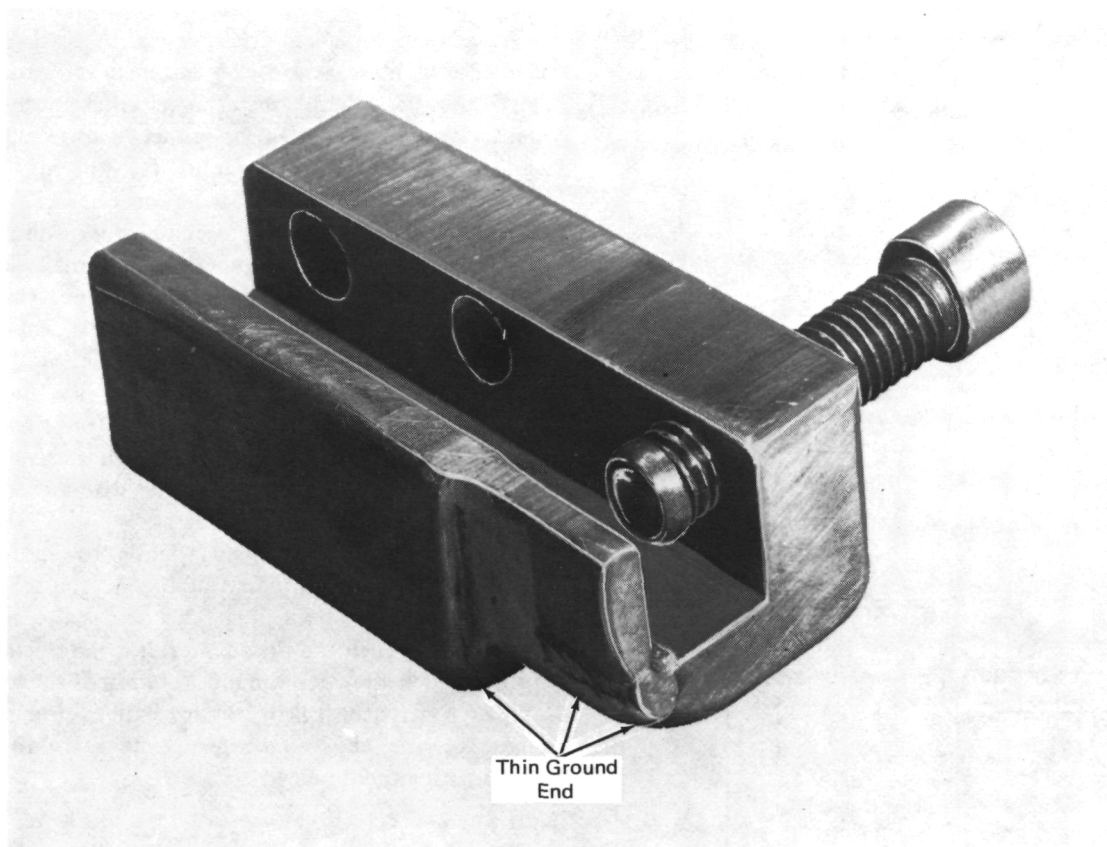


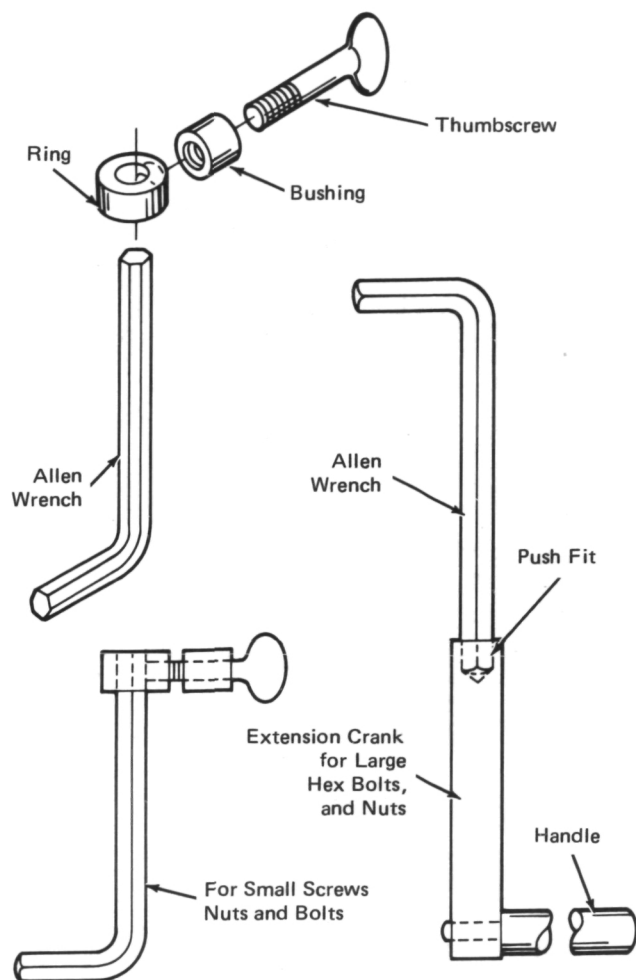
Figure 2. Tool Assembly

rivet (Figure 2). With the tool in place, the capscrew is tightened by hand with an allen wrench to upset the rivet. In order to enhance the utility of the tool in highly inaccessible areas, the block has three drilled and tapped holes and one end is ground thin.

Source: W. E. Parker and C. C. Hester of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-19353)

No further documentation is available.

ALLEN-HEAD SPEED WRENCH



Adaptors for Small and Large Wrenches

An adapter for allen wrenches can be used to drive allen screws, bolts, and socket fasteners in or out with great speed and with greater than usual torque. The adapter can be mounted on either end of any size wrench. It features a continuous, fast-rotating motion that drives a hexhead object in or out. No special dexterity is required, so that assembly work is improved.

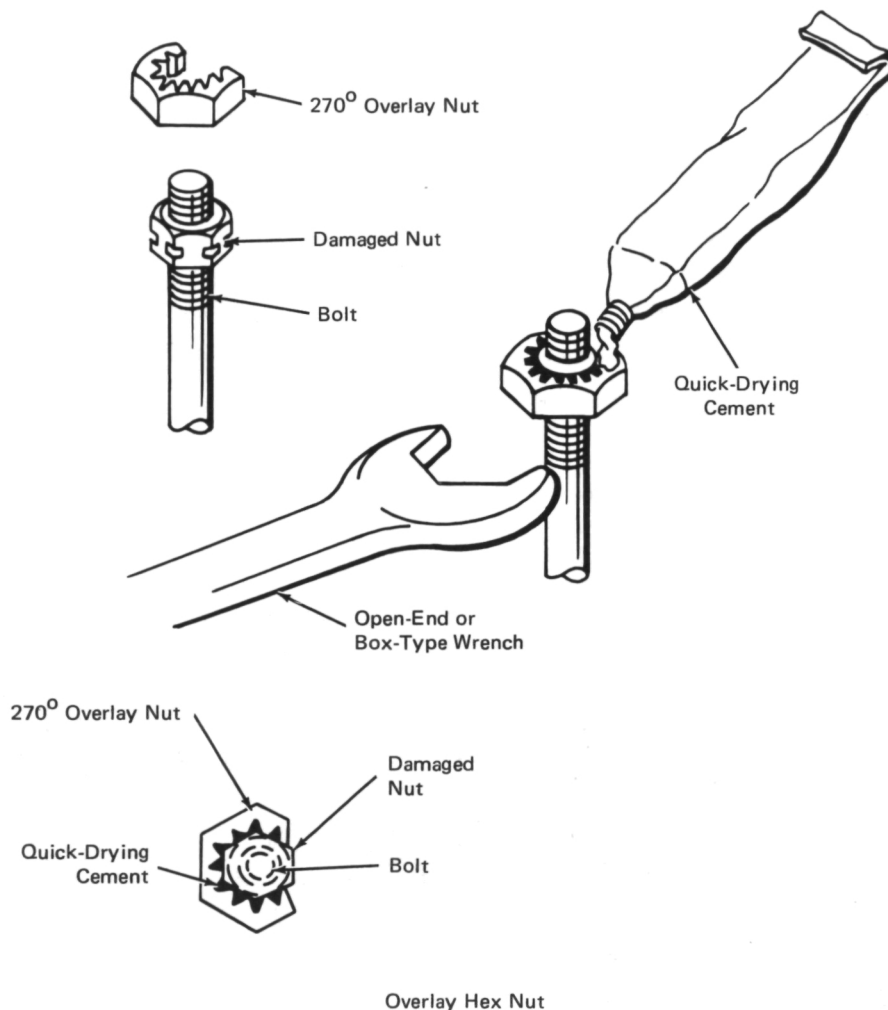
The figure shows adapters for a small [3/8-in. (0.952-cm)] wrench and also for a large one. The small crank adapter consists of a metal ring, 1.587 cm o.d. by 1.111 cm i.d. by 0.793 cm width (5/8 in. by 7/16 in. by 5/16 in., respectively), with a hole drilled into one side. A thumbscrew, 0.635 by 2.54 cm (8/32 by 1 in.) long, is installed in the ring along with a free-turning bushing. The bushing has an inside diameter slightly larger than that of the thumbscrew.

The thumbscrew is clamped tightly to one end of the allen wrench, against one of the six flat sides and against the inside of the ring. This step makes a single unit of the wrench and the adapter. It is the free-turning bushing which allows continuous rotation of the wrench. For large wrenches light tubing with a free-turning handle at one end can be made and force fitted or locked with a thumbscrew.

Source: M. V. V. Dussich of
The Boeing Company
under contract to
Kennedy Space Center
(KSC-10112)

No further documentation is available.

OVERLAY HEX NUT: A CONCEPT



A wrench used to remove a damaged hexagonal nut can slip or not work at all. A practical solution, to prevent injury to the operator and to facilitate removal of the nut, is shown in the illustration.

A 270° overlay nut is placed around the damaged or rounded nut to be removed; and a fast-drying material, such as quick-drying cement or liquid solder, is used to fill the spaces between the two nuts. When the material is dry, a wrench fitted around the 270° overlay nut can be turned to loosen the original nut which then can be removed and replaced safely. It is recommended that

the overlay nut be made of brass or aluminum, or any material that will not deform under severe stress.

Source: P. A. Straub and R. A. Rasmussen of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-17019)

No further documentation is available.

USED SAW BLADES AS GUIDES

An ingenious way has been found to recycle wornout bandsaw blades into guides for cutting tools, such as saber saws and routers. Any metalworking shop will find the method useful, since only an inexpensive, easily fabricated piece of scrap material is required.

The saw blade is placed between layers of pre-pregnated glass cloth and is heat cured in a press. The unit is ready for use immediately after the curing. The trailing edge of the saw remains exposed and serves as the guide, while the cutting edge of the saw provides a mechanical lock in the cloth material (see Figure 1). Figure 2 shows how the laminated blade is used as an edgewear insert for a saber-saw application.

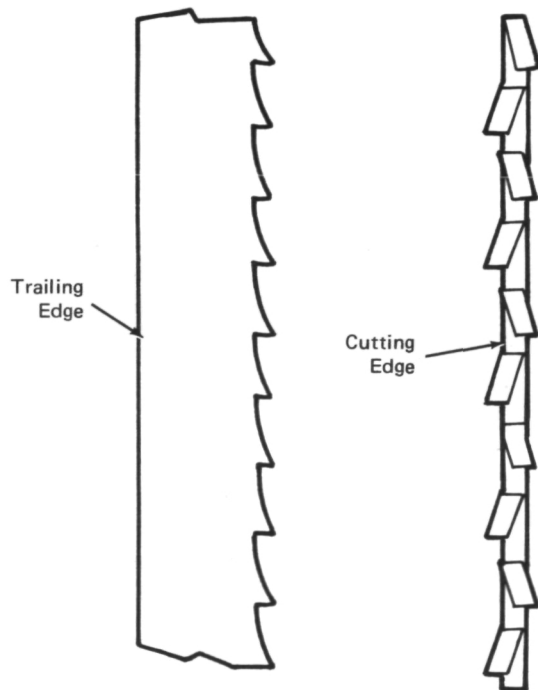


Figure 1. Saw Edges

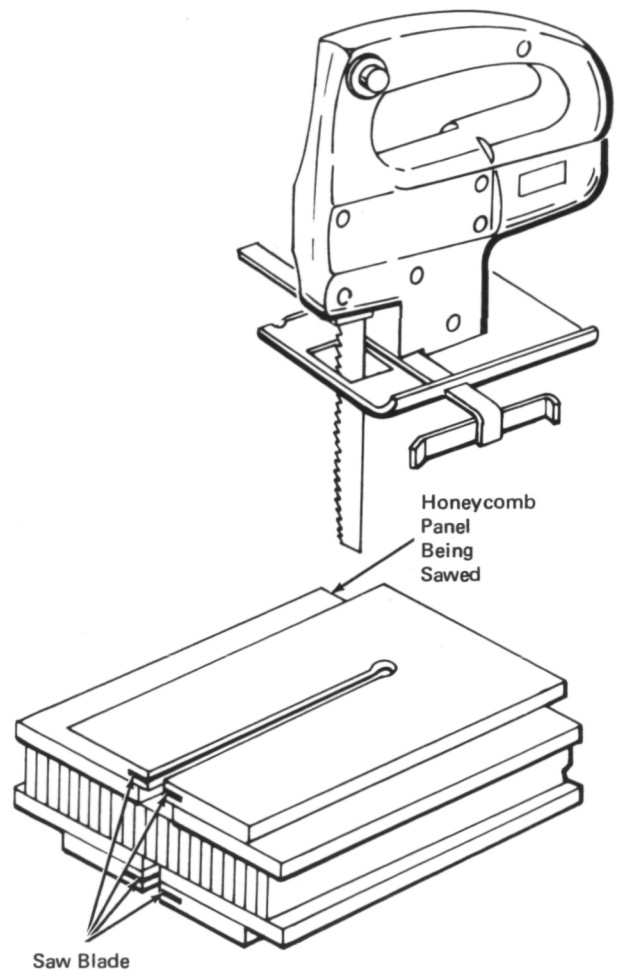
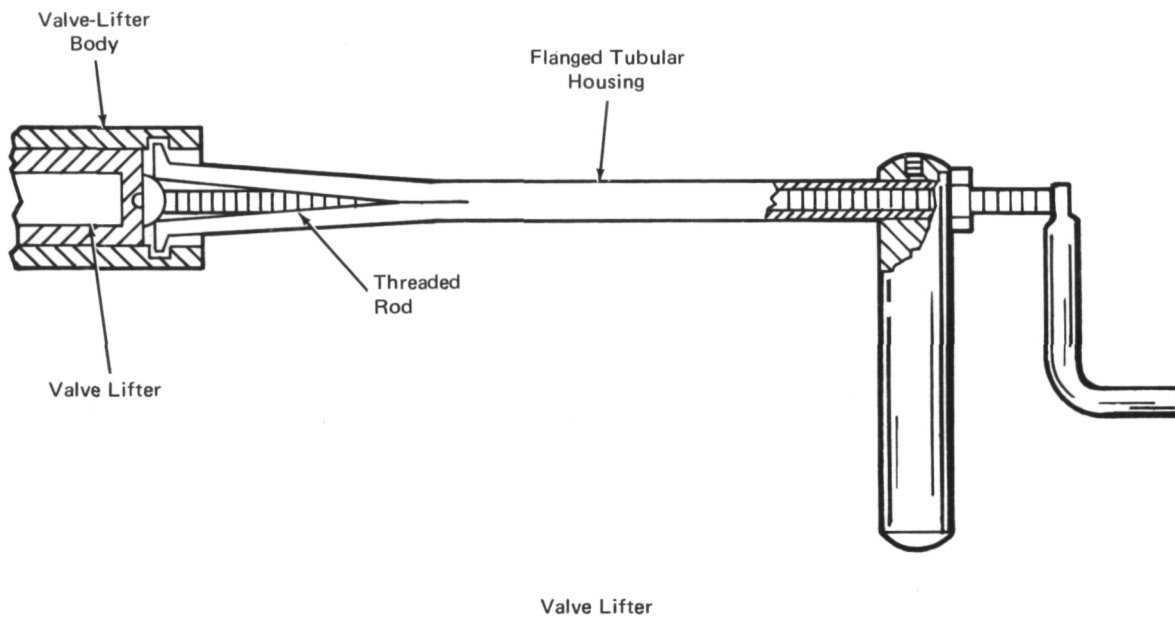


Figure 2. Used Saw Blade as Guide

Source: M. M. Gilman of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-17151)

No further documentation is available.

HYDRAULIC VALVE-LIFTER REMOVER



The removal of valve lifters from internal combustion engines requires extensive disassembly of an engine before the valve lifters are accessible. The time required to remove valves can be reduced by using a new tool for removing valve lifters.

In most instances, only the valve covers and push rods have to be removed before the valve lifters are taken out with this tool.

The removal tool is a threaded rod, mounted in a tubular housing which is flanged and expandable at one end. The flange is designed to engage an internal groove in the valve-lifter body. The tool is inserted into the

valve lifter and aligned with the internal groove in the valve-lifter body. The handle is then rotated counter-clockwise, spreading the housing so as to engage the groove. The valve lifter is then removed by removing the tool from the push rod hole.

Source: R. F. Horton of
Marshall Space Flight Center
(MFS-21377)

Circle 1 on Reader Service Card.

Section 2. Tools for Industry

TOOL REPAIRS TUBE COMPONENTS IN SITU

A portable tool has been designed in two versions: one for repairing the seats of tube fittings (half unions) and the other for repairing the flared ends of tubing. Each version operates on a like principle, that of lapping to remove imperfections from tube and fitting interfacing surfaces.

The version used to lap the conical surface of a half union is shown in Figure 1. The half union is screwed into the threaded end of the tool until it seats against the diamond-coated lapping surface. With the half union held against the lapping surface, the knurled drive wheel is rotated by hand until all imperfections have been removed from the conical surface that is to interface with a tube flare.

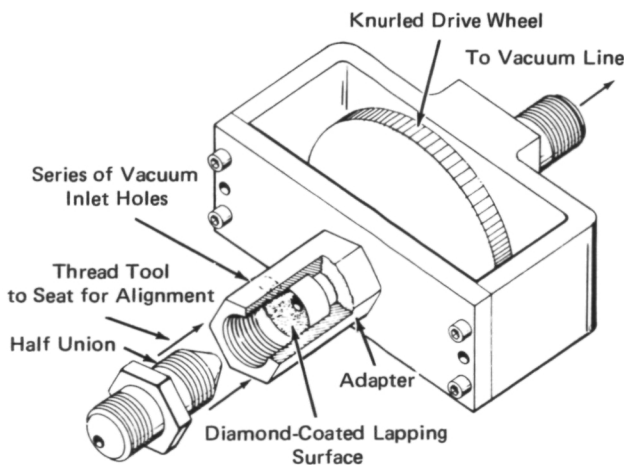


Figure 1. Tool Used to Lap Conical Sections

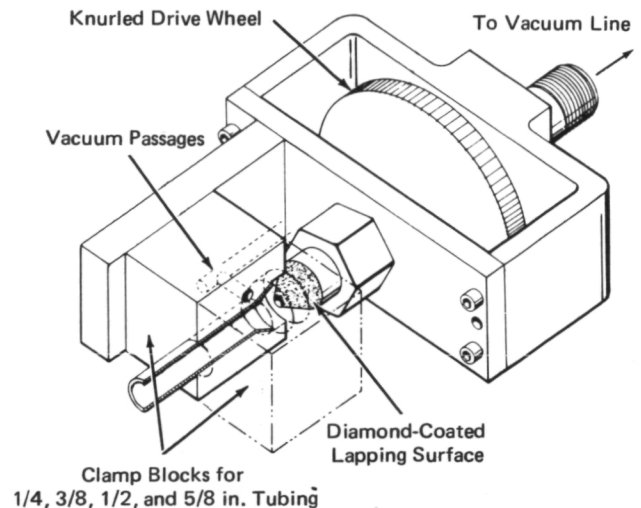


Figure 2. Tool Used to Perfect Tube Ends

The tool version used to remove imperfections from the flares on tube ends is illustrated in Figure 2. In this case, clamp blocks are used to hold the flare against the diamond-coated lapping surface while the knurled drive wheel is rotated by hand to achieve the lapping action.

A variety of adapters for the half union lapping tool and clamp blocks for the flare lapping tool permit cleanup of numerous sizes. In addition, each tool version includes a vacuum system for continuous removal of debris generated during the lapping operation.

Source: P. E. Tucker and R. L. Rush of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-15348)

No further documentation is available.

SPECIAL SPRAY TIPS FORMED WITH HEAT-SHRINKABLE TUBING

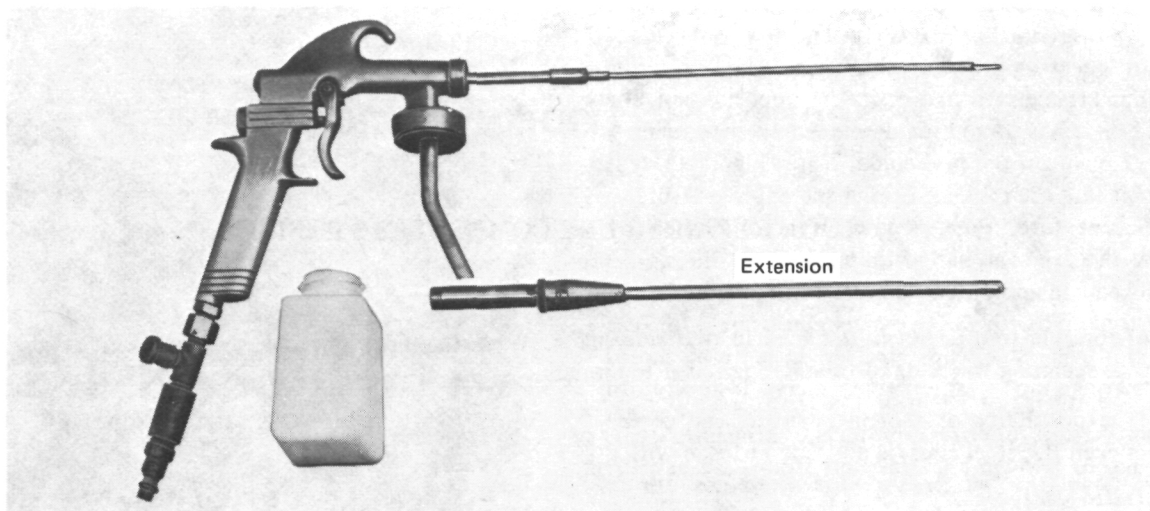


Figure 1. Spray Gun and Extension

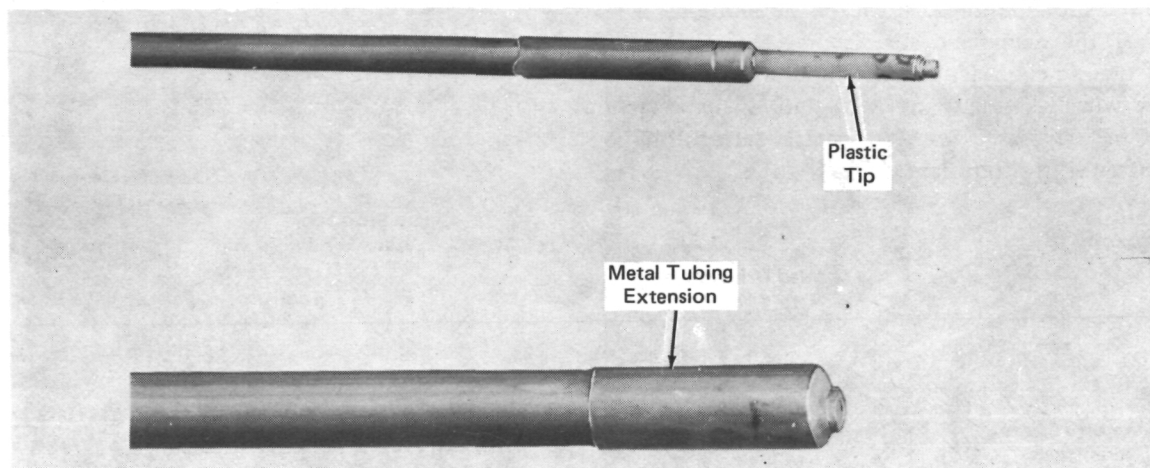


Figure 2. Plastic Tips on Metal Tubing

The spray head of a special spray-gun extension (see Figure 1) has been modified to allow the application of five special coatings in obstructed areas of electronic assemblies. Using heat-shrinkable tubing, fluid and air tips can be made quickly in desired sizes. The tips are made by shrinking the tubing onto drill shanks of various sizes with a standard heat gun. The tubing must withstand the heat of the liquid being sprayed.

It is also possible to extend simple syphon spray guns with small metal tubing to accept the plastic tips (see Figure 2). There is no shutoff needle; and, after the tip size has been determined, the spray is controlled by the

airflow only. Although these tips have limited life, they are an inexpensive alternative to sophisticated spray extensions when continued or heavy use is not required.

Source: F. E. Stoner of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-17264)

No further documentation is available.

FUSE INSTALLATION AND REMOVAL TOOL

A simple plastic tool can be used to install and remove glass-tube fuses quickly and safely. The new tool is made of acrylic sheet 0.64 cm (1/4 in.) thick with two spring steel clips attached to one end. The opposite end, the removal end, has a contour developed to slide under a fuse and pivot on the fuse-holder plate (Figure 1). It is important that the tool not extend and apply pressure to the adjacent fuse. Fuse removal is accomplished by hooking the removal end of the tool under the fuse to be removed and applying a sideward force (Figure 2).

The tool end with the two steel clips is used for fuse installation. The steel clips are held in place by means of insulating tape, rather than metal fasteners, to reduce the possibility of shorting. On the end of the tool, between the steel clips, is a plastic pedestal with a concave curvature which supports the fuse during installation. The length of this pedestal is designed to be shorter than the distance between the two fuse-holding clips on the fuse-holder plate.

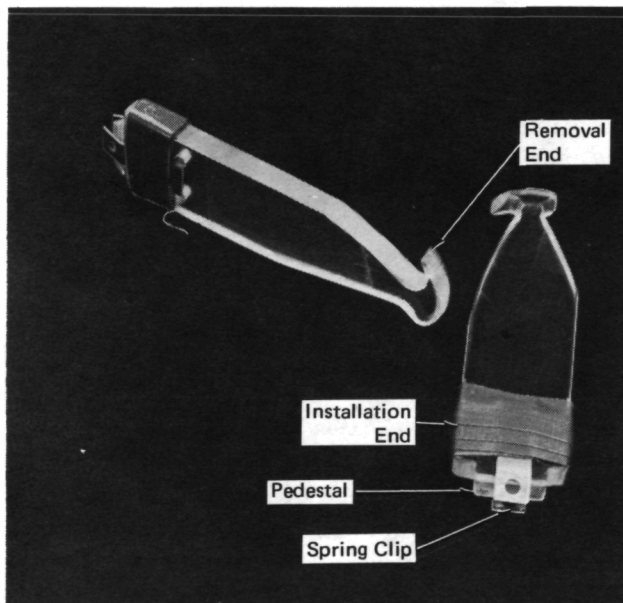


Figure 1. Fuse Removal and Installation Tool

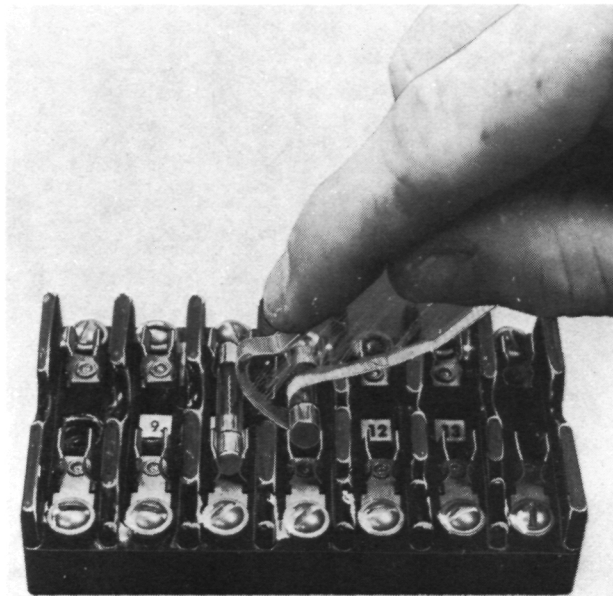


Figure 2. Removal of a Fuse

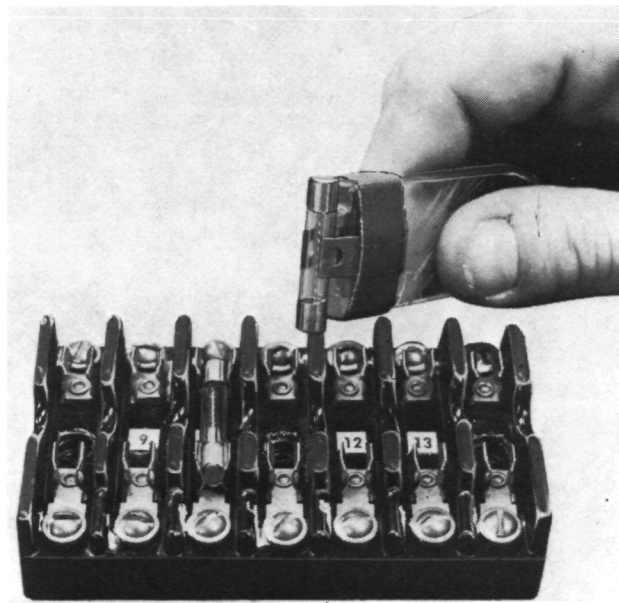


Figure 3. Fuse Mounted on Tool Prior to Insertion

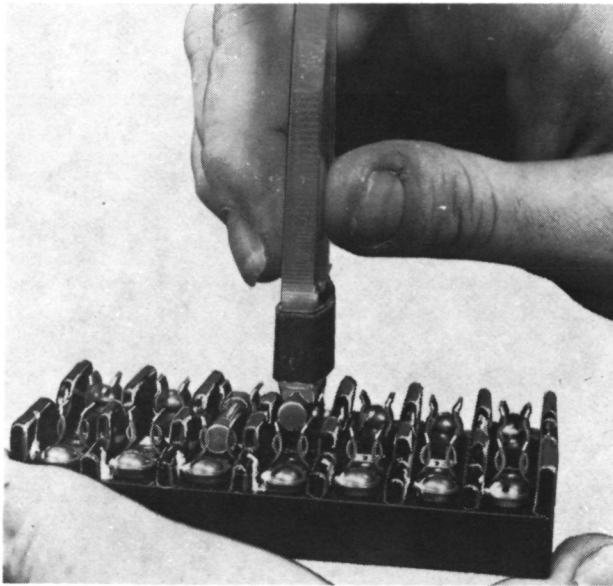


Figure 4. Installation of a Fuse

In Figure 3 a fuse which is to be inserted is shown mounted between the spring clips of the tool. Figure 4 shows the fuse being installed on a fuse holder; straight push is all that is needed to seat the fuse. The tool has not exhibited any tendency to roll the fuse; this is an advantage when the amperage rating of the fuse, marked on the metal portion, must be shown facing the observer. Use of the tool has resulted in a fourfold reduction in labor and time and a considerable reduction in operator fatigue, as compared to either manual or commercially available tool usage.

Source: F. S. Kender and
J. O. Fuller of
The Boeing Company
under contract to
Kennedy Space Center
(KSC-10686)

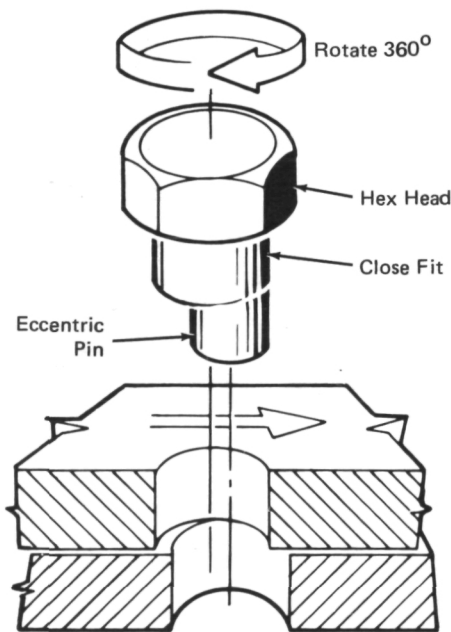
No further documentation is available.

ECCENTRIC-PIN ALIGNMENT TOOL

When heavy precision-bolted assemblies are forcibly aligned, the holes tend to become scored and the edges burred. This requires filing or ream cleaning before all

alignment steps are finished. A new cam-type alignment tool solves this time-consuming problem. As shown in the illustration, the tool is a hex-headed eccentric pin which is usable with standard wrenches and sockets. The tool works on the principle of off-center cam action that provides mechanical leverage; and the close fit of the pin maintains the alignment, thus preventing damage to the hole surface.

The pin is inserted manually as far as possible into the holes to be aligned. The hex head then is rotated 360° to bring the holes into precise alignment. When this is done, the assembly is clamped, the tool is removed, and the final bolts are installed. The tool is easily machined from a standard bolt and can be made in sizes other than the one shown. It will be very practical when thick heavy flat plates have to be stacked.



Eccentric-Pin Alignment Tool

Source: V. L. Cimino
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-19350)

No further documentation is available.

CABLE TENSIOMETER ATTACHMENT FOR TORQUE WRENCH

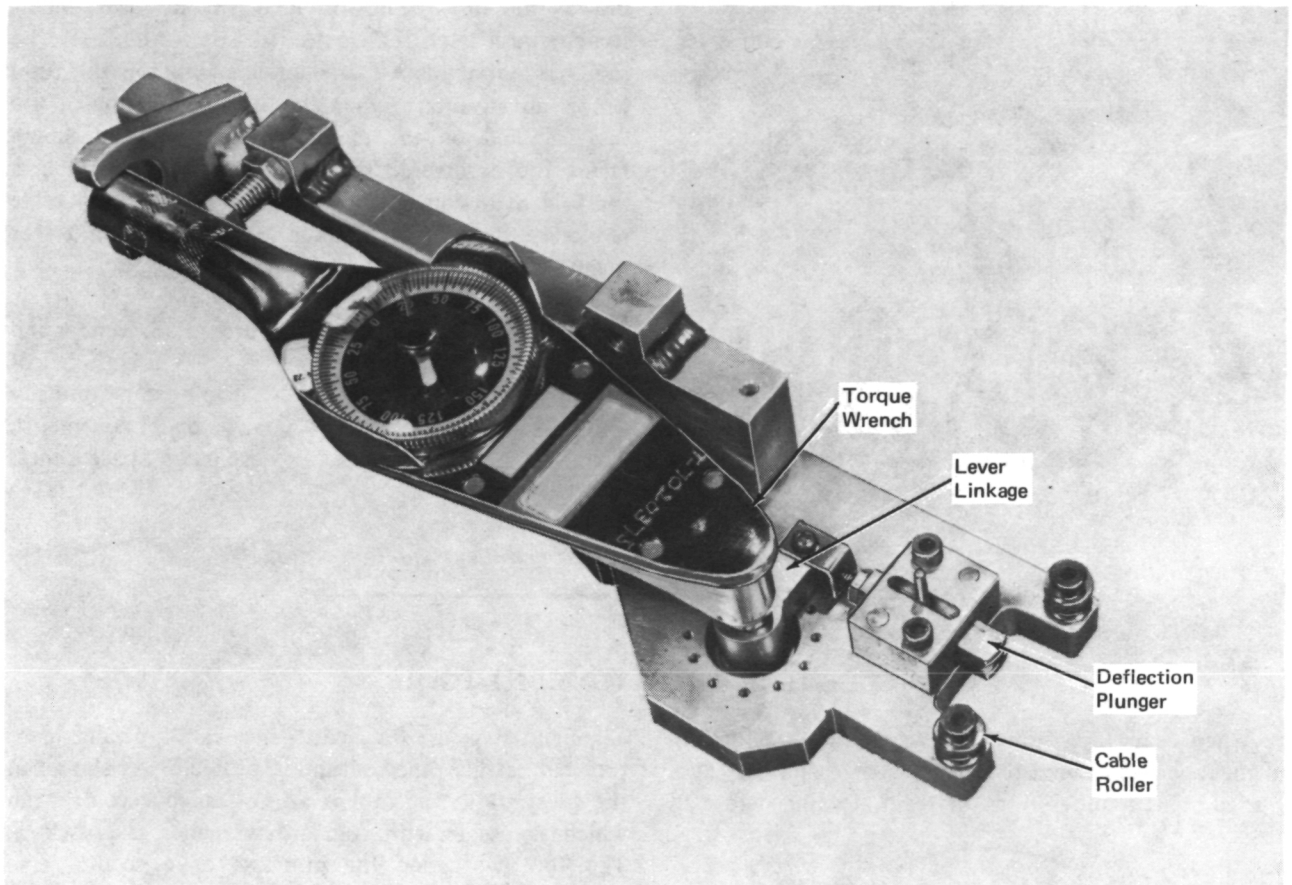


Figure 1. Tensiometer with Torque Wrench and Readout

Figure 1 shows a new cable tensiometer which utilizes a standard torque wrench to apply a cable-deflecting load, through a linkage, to a deflection plunger. The tensiometer can be extended to reach difficult areas. Accuracy is high, and only a minimum cable length is needed to obtain tension data. Furthermore, the cost of the device is relatively low.

To obtain exact readings, a special calibration unit is required (Figure 2). This unit allows a variable tensile stress to be applied to a reference cable, to which the tensiometer then is applied. A force gauge readout of cable tension provides calibration data. The effective length-to-pivot-linkage ratio of the torque wrench must be known in order to calculate appropriate scale adjustments.

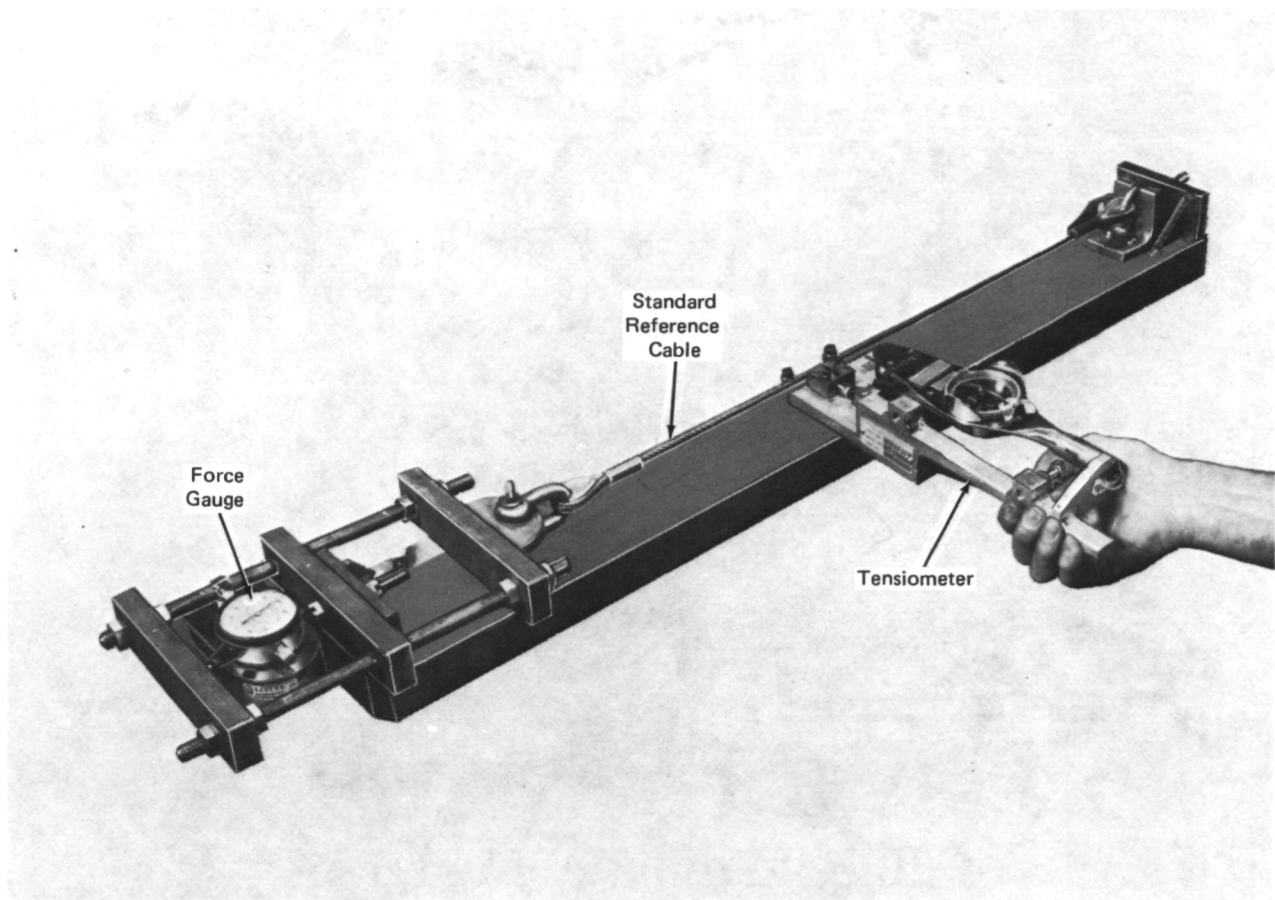


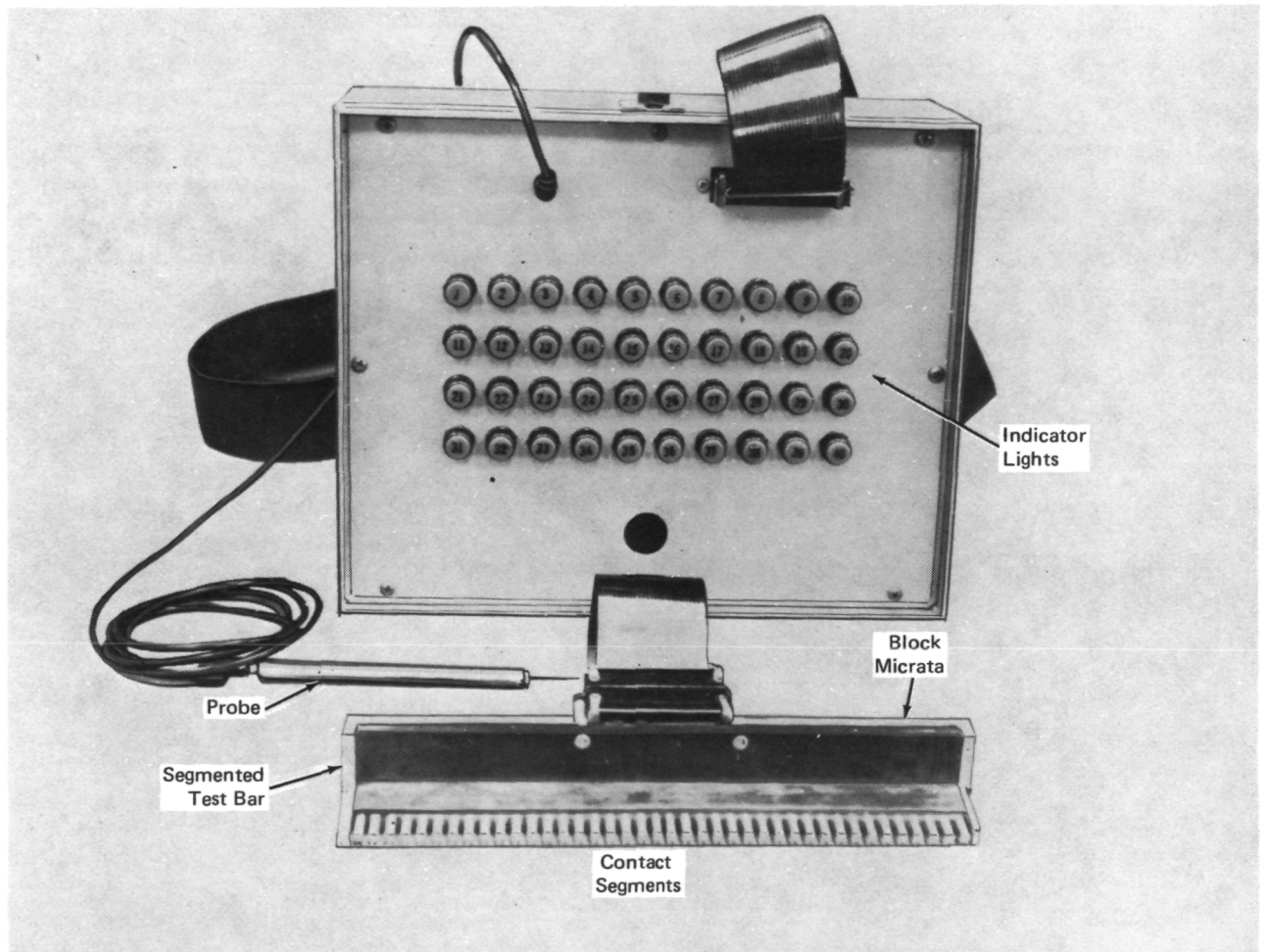
Figure 2. Tensiometer and Calibration Unit

Essentially the torque wrench is used to apply a known torque about a point. The resultant rotation of a small lever linkage activates a deflection plunger which then applies the load to the cable, midway between two rollers. This attachment should be of interest to commercial tensiometer and torque-wrench manufacturers and others needing a low-cost tensiometer.

Source: J. A. Stein and J. L. Zepeda of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-19326)

Circle 2 on Reader Service Card.

SEGMENTED ALIGNMENT BAR FOR PATCH DISTRIBUTOR PADDLE-PIN ALIGNMENT TESTS



Segmented Paddle-Pin Alignment Bar

An electrically-segmented test bar can be used to check the alignment of contact pins in electrical support-equipment (see figure). In the past, such test bars have been used to visually check pin alignment. This bar consists of brass studs (test probes) imbedded in an insulating (e.g., micrata) block.

Each stud is connected to its own light in a separate box. The probe of a test point with this bar will turn on a specific light only if the pin under test is making contact with its related portion of the bar.

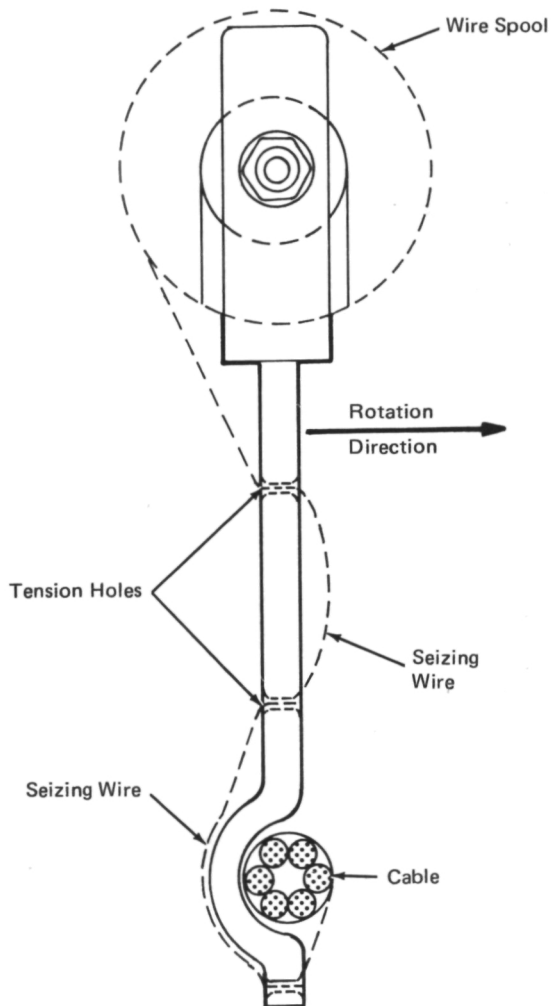
No-touch tests can be performed with the same bar, using the different fixed distances from the centerlines

of the studs to the sides of the studs. In this position, any pin that turns on a light when probed is out of tolerance and must be corrected. Printed circuits reduce the weight of the bar, and the entire assembly is encased in a small box for portability.

Source: David M. Gilliam and
James A. Foster
Kennedy Space Center
(KSC-10740)

Circle 3 on Reader Service Card.

SEIZING TOOL FOR WIRE ROPE



Seizing Tool for Wire Rope

When stranded steel cables are cut, the ends of the individual strands tend to fray and become a safety hazard. It is common to restrict this fraying by wrapping seizing wire around the cables on either side of the points where the cuts are to be made. A new tool makes the seizing operation more efficient: it applies the seizing wire with uniform tension, and it holds a spool of wire in readiness for many cable-forming applications before it needs to be replaced. The figure shows the tool and how it is used.

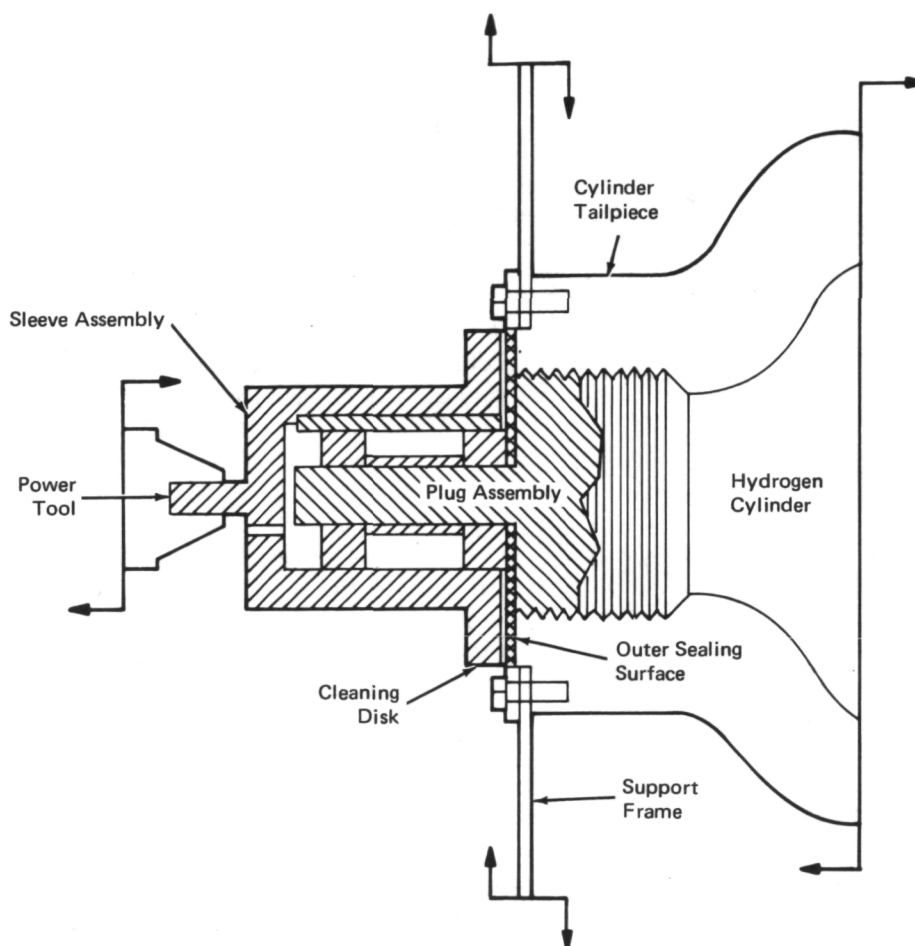
A spool of wire is placed on a phenolic spindle 2.5 cm (1 in.) in diameter, and is held in the spool holder with a machine screw. The wire end is threaded through the tension holes; and with about 7.6 cm (3 in.) of the wire end placed parallel to a cable, one turn around the cable is made so that the overlap holds the end in place. The tool is rotated in this position as shown in the figure until a sufficient width of seizing wrap has been applied. Next the free end of the wire is pulled tight, is twisted with the wire from the last turn, and is cut from the tool end. With the seizing held firmly in place by the two wires twisted together, the twist is cut to about 0.64 cm (1/4 in.) in length and is pressed into the cable groove.

The holes in the shaft provide the tension; for instance, with the two holes shown, the tension is sufficient for 0.081 cm (0.032 in.) annealed steel wire. The wire size and stiffness determine how many tension holes to use. Tension adjustments also can be made by wrapping the wire around the outside of the shaft.

Source: C. E. Small of
Bendix Corp.
under contract to
Kennedy Space Center
(KSC-10690)

Circle 4 on Reader Service Card.

RESURFACING TOOL FOR LARGE HIGH-PRESSURE GAS CYLINDER ENDCAP SEALING SURFACE



Resurfacing Tool Mounted in Operational Configuration

A new polishing tool removes corrosion buildup on the surfaces of a gas distribution system. It permits the outer-seal surfaces of large gas cylinders to be refinished in half the time previously required. The tool, which consists of a threaded plug guide and a rotating sleeve, also could be used to resurface or polish other similar sealing surfaces.

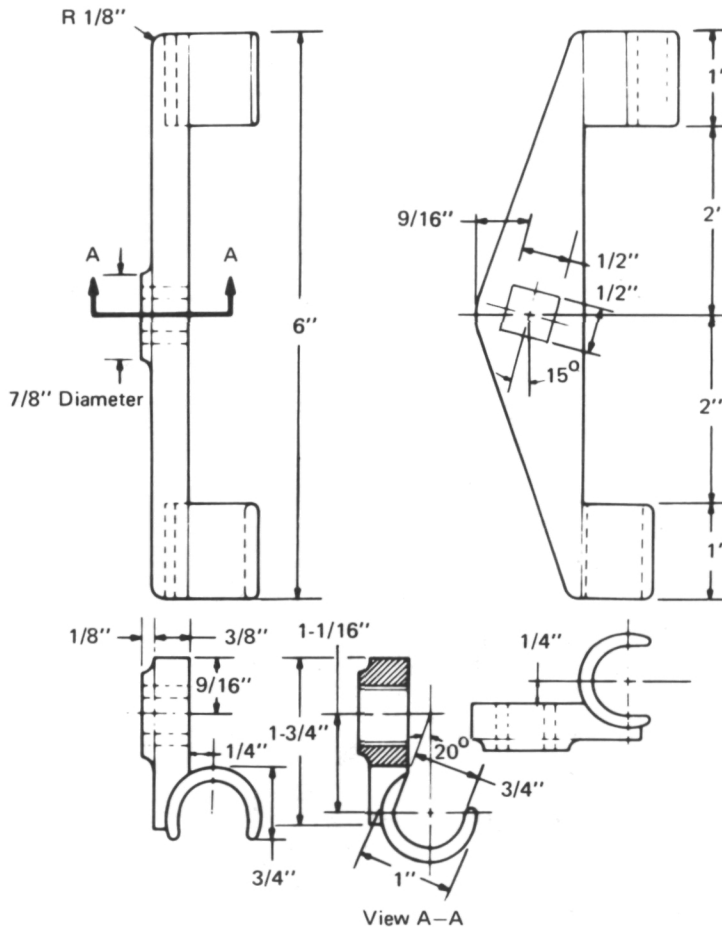
In the illustration the resurfacing tool is shown mounted on a gas cylinder, to polish the outer sealing surface. Rather than use a conventional rotary disk, a stationary arbor (plug assembly) is inserted in the endcap opening of the cylinder and a rotating tool (sleeve

assembly) and a cleaning disk are placed around it. A pneumatic or electric power tool with a capacity of 1.27 cm (1/2 in.) is used to rotate the sleeve assembly.

Source: W. L. Bessette of
The Bendix Corp.
under contract to
Kennedy Space Center
(KSC-10732)

Circle 5 on Reader Service Card.

A TOOL FOR MEASURING ELEVATOR CABLE TENSION



Cable Tensiometer

Many elevators and some lifting systems are supported by a set of cables or ropes. To avoid uneven and excessive wear, each cable or rope should be adjusted to carry equal weight. However, present tools used for checking cable tension are complex, bulky, and costly.

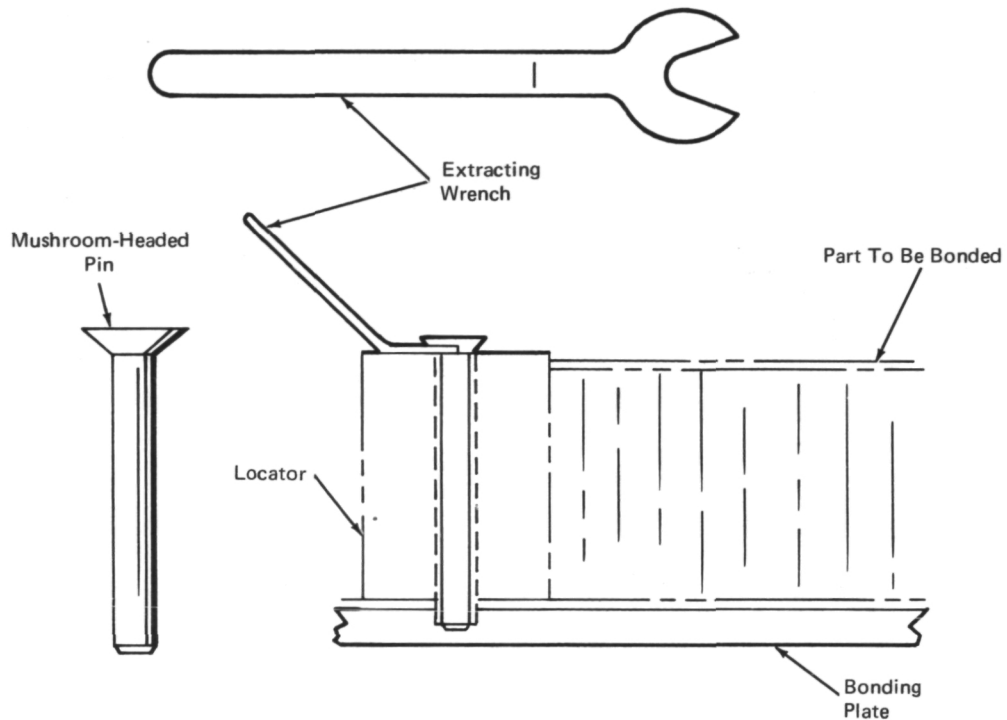
A simple tool has been designed to measure relative cable tension. The tool is used with a $1/2$ -inch (1.27-cm) drive torque wrench, weighs approximately 2 pounds (1 kg), and can be produced at one-tenth the cost of the existing tools.

The design, as shown in the figure, has two U shaped ends to grip the elevator cable along its length. A torque wrench with a 0-to-100-foot-pound (0-to-135.6J) capacity is then inserted into the tool socket and twisted

to check the cable tension. Readings are taken with a Cee-hook holding the wrench handle a uniform distance from the cable. If tension is incorrect, the particular cable is adjusted by a thimble retaining nut. This process is repeated until all of the cables are checked and adjusted to carry equal weight.

Source: E. Lowell Weaver of
Bendix Corp.
under contract to
Kennedy Space Center
(KSC-10708)

Circle 6 on Reader Service Card.

MUSHROOM-HEADED PIN AND EXTRACTING WRENCH FOR BONDING TOOLS

Mushroom-Headed Pin and Extracting Wrench

The mushroom-headed pin shown in the figure allows the precise alignment of parts during a bonding process, and it allows the easy fitting of a vacuum bag over the entire surface of a part during bonding without puncturing the bag. The pin can be removed by the extracting wrench also shown in the figure.

When a standard jig pin is used, the vacuum bagging of a part is very difficult. The tools are novel in that they permit the precise alignment of parts during bonding without interfering with the bonding process.

Source: R. G. Bird of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-15845)

No further documentation is available.

SPECIAL WRENCH FOR B-NUTS REDUCES TORQUE STRESS IN TUBING

A novel gear-driven torque wrench with bearing support can be used to tighten the B-nut connection of a partially supported fluid line, with minimum stress to the adjacent tubing and fittings.

The new wrench has a unique, manually clamped, split-half socket assembly and drive, with split special gears and bearings. The guide bearing, gear, and socket assembly are retained using the T-handled socket to actuate the split collar (Figure 1). When the wrench is around the nut, the torque drive is operated by the larger handle (Figure 2).

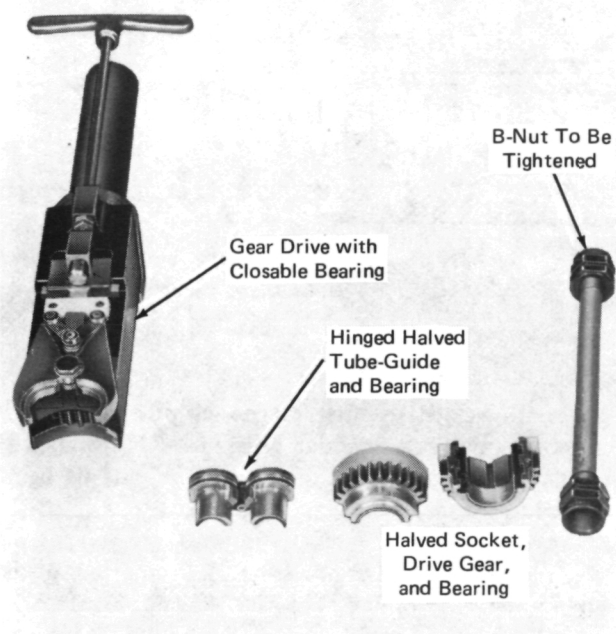


Figure 1. Unassembled Components

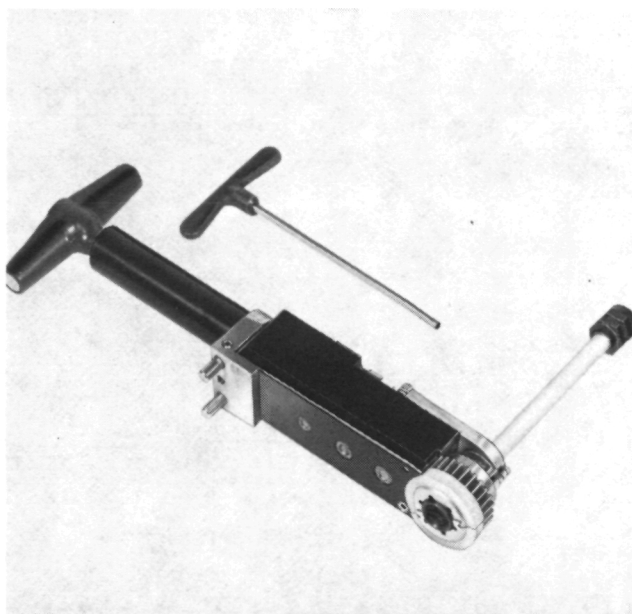


Figure 2. Wrench Assembled on a Nut

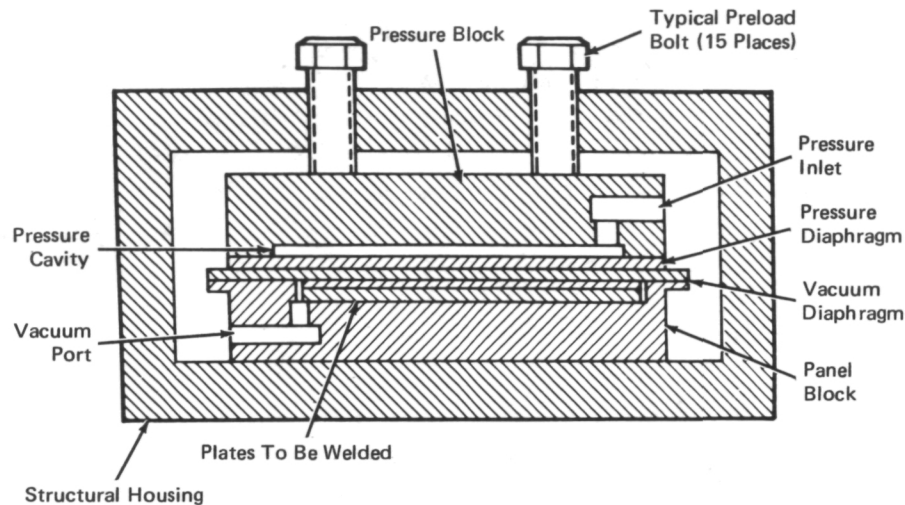
The wrench may be useful for working with weak or brittle lines such as glass tubing.

Source: John A. Stein of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-15885)

Circle 7 on Reader Service Card.

Section 3. Metal Working Tools

DIFFUSION WELDING TOOL



A diffusion welding tool has been built and tested which allows flat plate diffusion welding to be done in a standard brazing furnace. The tool consists of a structural box which houses a pressurizing diaphragm block and a block for holding the plates to be welded, as shown in the figure. A thin metal diaphragm is seam welded over the plate to be bonded in order to provide a vacuum atmosphere. Another thin metal diaphragm is seam welded in place on the pressure block so that fluid pressure can be transmitted uniformly to the plates. Vacuum and pressure piping connections are provided as shown. The tool is constructed completely of a nickel-base alloy.

The plates to be welded are placed in the panel block beneath the vacuum diaphragm, and the vacuum diaphragm is seal welded in place. The panel blocks and pressurizing block are placed in the structural housing, and preloading bolts are tightened against the pressure block. The entire assembly is placed inside a standard brazing furnace having an inert or reducing atmosphere, and vacuum and pressure lines are connected. After the assembly reaches welding temperature, water at high pressure is applied to the pressure diaphragm using a

hand-operated positive-displacement pump, and the plates are welded together. A coating of a commercial stop-off solution containing yttrium-oxide in methyl cellulose on the vacuum diaphragm prevents its being welded to the plates.

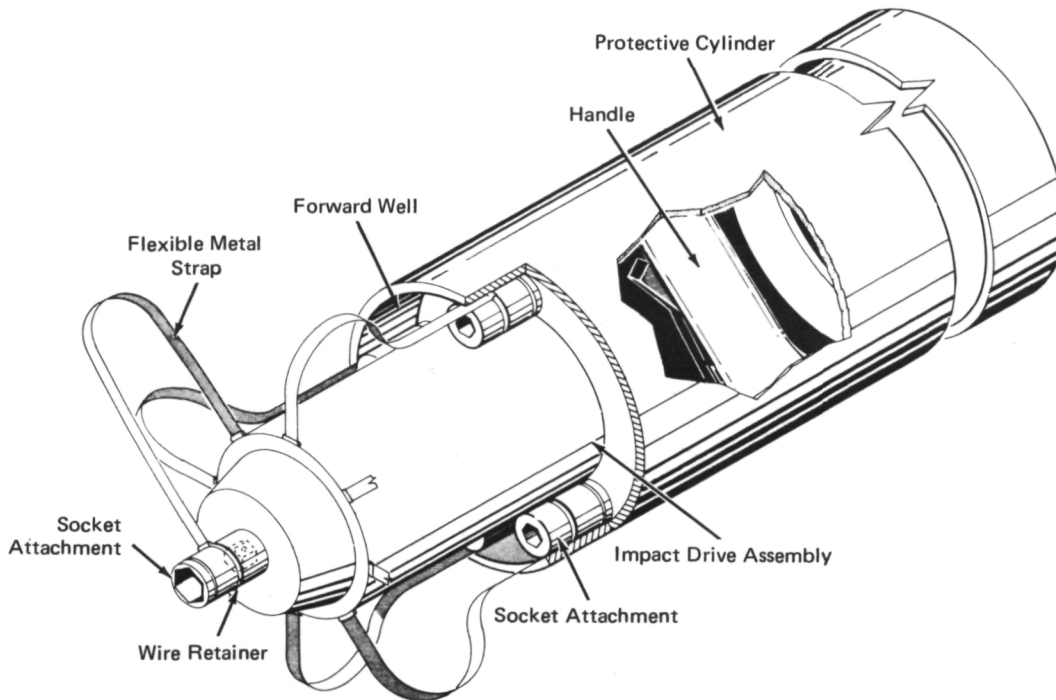
At the operating temperature and pressure, some steam is generated in the pressure block and part of the supply pressure tubing, but the volume of steam is small enough that the system acts as if an incompressible fluid is being used.

Good welds have been obtained between nickel and nickel-base alloy plates during tests of the tool at a temperature of 1200 K (1700° F) and a water pressure of 13.8×10^6 N/m² (2000 psi).

Source: Thomas B. Milam of
Pratt & Whitney Aircraft Corp.
under contract to
Lewis Research Center
(LEW-11807)

No further documentation is available.

MULTIPURPOSE TOOL MITTEN



Tool Mitten

Tasks to be performed by astronauts during extra-vehicular activities require a means of keeping power tool attachments from drifting away from the activity site. While the tools are designed specifically for a space environment, the novel techniques employed to prevent the attachments from drifting away may have industrial applications. On steel scaffolding or in high building maintenance where the operator has no available surface on which to place tools, these space tool techniques might be useful. The proposed tool concepts might also be adapted to underwater environments.

One tool has been proposed and a prototype built that has made the attachments an integral part of the tool. This device, the Tool Mitten, provides a low reaction-torque source of power for wrench, screw-driver, or drill activities. An impact drive assembly is positioned at the center of the front panel of the protective cylinder of the tool, as shown in the diagram. The attachments are stored in the forward well when not in use. A flexible metal strap is connected to a wire retainer set in a groove on the attachment, and then to a steel ring located on the forward periphery of the drive housing. By bending the metal strap, an attachment can be brought out of the forward well and inserted on the fitting of the impact drive.

When power is applied, the wire retainer slips freely in the groove on the attachment. The attachment can be disengaged and returned to the well without the necessity of being free of the tool.

Alternate methods to prevent attachments from leaving the activity site have been proposed. One method, the tool cuff, retains wrench sockets with threaded tapered studs having capture nuts at the small end of the taper. The cuff could be attached to the operator's arm or leg, eliminating the need for a tool box.

The following documentation may be obtained from:

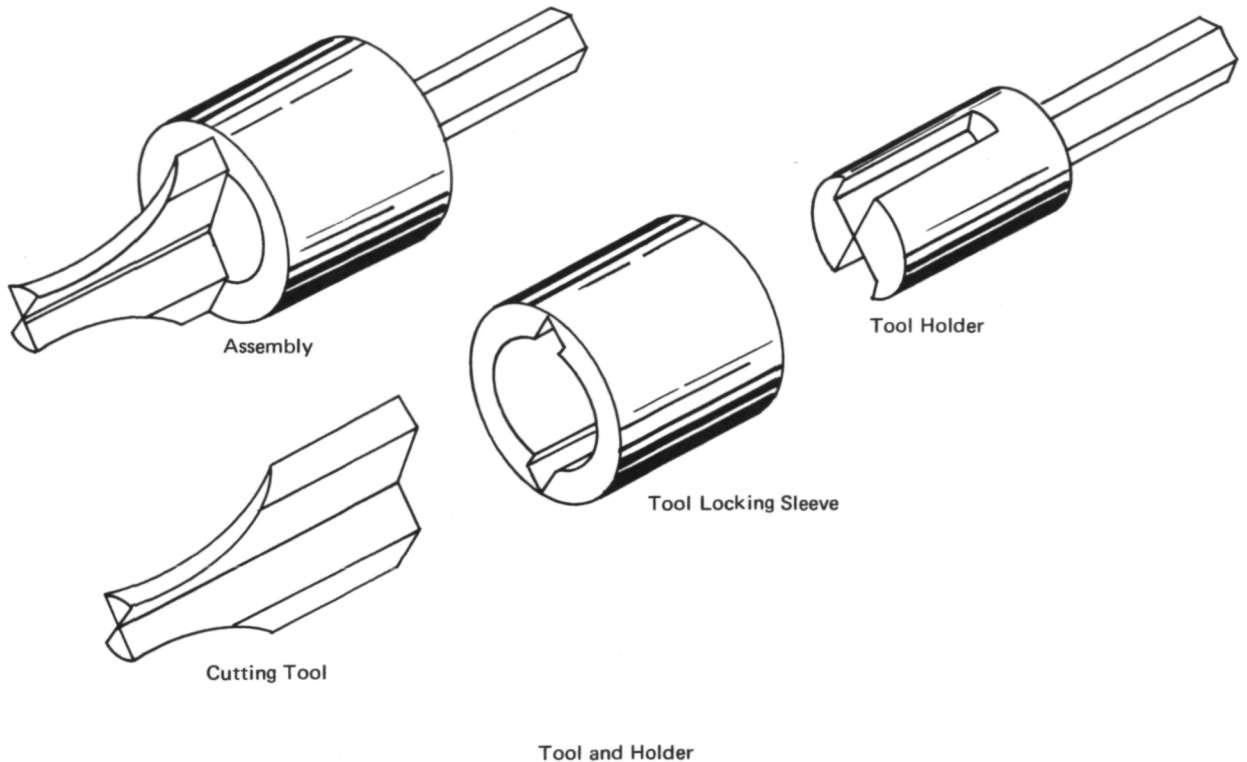
National Technical Information Service
Springfield, Virginia 22151
Single document price \$3.00
(or microfiche \$2.25)

Reference: TSP69-10483 (TB-186500)

Source: E. F. Wilcomb of
Raff Analytic Study Associates, Inc.
under contract to
NASA Headquarters
(HQN-10047)

Circle 8 on Reader Service Card.

MILLING TOOL HOLDING ADAPTER



Precision-machined parts that have nonstandard surface configurations (such as compound odd-size radii) require specially ground milling tools. The usual shop practice is to regrind standard endmills to fit the particular requirements of a complex nonstandard job. A new holding tool allows special milling tools to be made from inexpensive steel tool stock. This procedure is usually more economical and simpler than reworking standard endmills.

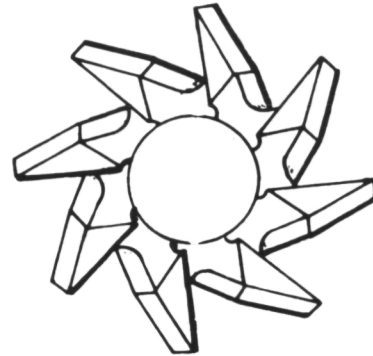
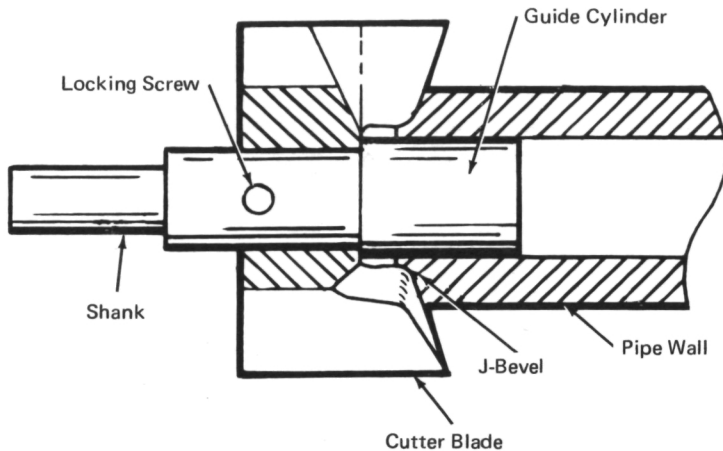
The holding tool, along with a milling tool cut for a special job, is shown in the figure. The milling tool, which is made from pieces of tool steel, is held on the tool holder by the tool locking sleeve and a setscrew.

Since the milling tools are all made specially for this device, any number of them may be used interchangeably with the same holder.

Source: Stanley T. Matus of
The Bendix Corp.
under contract to
Kennedy Space Center
(KSC-10578)

No further documentation is available.

J-BEVELING OF PIPE ENDS WITH A HAND-HELD TOOL



End View of Cutter

A tool has been developed, for use in the field, to cut J-bevels on the ends of stainless-steel or aluminum pipe that is to be joined by precision welding. Previously, bevels were roughed-out with an air grinder and then finished by manual filing. This method is very slow and results in many rejects.

The J-bevel cutter is adapted to be driven by a hand-held, variable-speed power drill. The cutter is mounted on a shaft having a 0.5-inch (1.27-cm) shank, which fits into the drill chuck, and a guide cylinder matching in diameter the bore of the pipe. To use the tool, the operator simply slides the guide into the pipe, turns on the power, and applies the cutter to the pipe end. Different sized cutters and guides are required for different pipe diameters. With this tool an acceptable bevel can be cut with 3 percent of the time required for grinding and filing.

A single shop tool that prepares a pipe end for precision welding by simultaneously performing internal machining, end facing, and J-bevel cutting to precise standards is described in NASA Tech Brief 69-10231. Other portable tools that prepare pipe ends for weld joining are described in NASA Tech Brief 66-10145 and 68-10551.

Source: S. T. Matus of
The Bendix Corporation
under contract to
Kennedy Space Center
(KSC-10356)

No further documentation is available.

METAL DRILLING WITH PORTABLE HAND DRILLS

The problems of excessive burring, oversized holes, and out-of-round holes were among those studied during an investigation into the equipment and procedures used in drilling metals with portable hand drills. The study was aimed at defining the causes of such problems and recommending corrective measures. In the process, acceptable burr heights were also defined.

In general, the conclusions and recommendations resulting from the study include guidelines for operating portable hand drills; specific instructions for drilling nonferrous metals, titanium and steel and their alloys, and aluminum and aluminum alloys; and recommendations to manufacturers for improving their equipment.

Specifically, the study revealed that mechanical instability and vibration were major contributors to drill degradation and low quality holes. Furthermore, when spindle speeds were inadequate, chips entered and choked the flutes, and cut off the coolant flow to the cutting interface.

One conclusion was that the clamping force on the metal piece to be drilled should be increased considerably in order to reduce burr heights. Recommendations deal with using the proper chemical coolants, applying the coolants effectively, employing cutting oils, and dissipating the heat caused by drilling.

The results of this study have already been applied by portable and hand drill manufacturers, and improved hand drills are now available.

Source: H. W. Harrison, W. B. Edmiston,
and H. E. Morris of
The Boeing Company
under contract to
Marshall Space Flight Center
(MFS-15180)

Circle 9 on Reader Service Card.

DEBRAZING TOOL FOR LIMITED-ACCESS AREAS

This hand-operated tool can remove a sleeve or union from a brazed joint without disturbing adjacent parts. The tool is a circular glass enclosure with an argon-gas atmosphere, an end support, a purge block, and a heating coil. It is constructed in two semicircular halves that fit in a clamshell fashion around the union to be debrazed.

The union is heated by an induction coil as follows. An induction generator produces a radio frequency electromagnetic field around the brazed joint. The changing field induces eddy currents in the pipe. Within 22 seconds the resistance of the brazed union to the eddy currents generates sufficient heat to melt the braze.

When the braze melts (clearly visible to the operator), the union is slid off by pulling or pushing the handle. The union is moved just enough to clear the tube end, for instance, 0.64 cm (1/4 in.) for a 1.59-cm (5/8-in.) joint. The defective part is then available for failure analysis.

Source: J. A. Ruiz of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-17461)

No further documentation is available.

Patent Information

The following innovations, described in this Compilation, have been patented or are being considered for patent action as indicated below:

Hydraulic Valve-Lifter Remover (Page 9) MFS-21377

Inquiries concerning rights for the commercial use of this invention should be addressed to:

Patent Counsel
Marshall Space Flight Center
Code CC01
Marshall Space Flight Center, Alabama 35812

**Segmented Alignment Bar for Patch Distributor Paddle-Pin Alignment Tests
(Page 16) KSC-10740**

Inquiries concerning rights for the commercial use of this invention should be addressed to:

Patent Counsel
Kennedy Space Center
Code AD-PAT
Kennedy Space Center, Florida 32899

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